When the mercury tube of the so-called electrometer is set up, the two surfaces of the mercury in contact with the acid are, I believe, almost always electrically unequal, that in the capillary being less oxidised than the other, and therefore positive to it. When the circuit is closed, a feeble current passes which, if it were strong enough, would move the mercury forwards. When a telephone is in action in the circuit, its equal and opposite currents combine alternately with the mercury current which strengthens the impulses in one direction and weakens those in the other; so that, whilst the sum of the telephone and mercury currents may be able to move the mercury in one direction, the difference of these currents is not able to move it in the other. Hence, I believe, arise the motions in question.

It of course follows that if, by accident, the potentials of the two mercury surfaces were equal, the telephone currents would produce no movement whatever in the mercury. Moreover if by variation of temperature, or by difference of strength of acid at the contact faces, or otherwise, the mercury surface in the capillary is rendered negative to the other surface, the accidental current set up will be in the opposite direction, and the tendency will be for the mercury to recede in the tube, as was observed in the experiment performed before the Physical Society.

Mr. Page's experiment will, I have no doubt, suggest a means of deducing the potentials of the telephone impulses.

ROBERT SABINE

AFTER reading the experiments of Prof. Forbes on the telephone, in NATURE, vol. xvii. p. 343, it occurred to me, as probably it has done to others, that this instrument might be employed in comparing the electrical resistances of wires. Accordingly, two weak cells were connected with the ordinary form of Wheatstone's bridge, and the telephone placed in the position usually occupied by the galvanometer. The current was rendered intermittent by a small electromagnetic apparatus belonging to an electric bell; the bell itself having been detached, the intermitter was placed in a separate room, and connected by long wires with the battery and bridge. The German silver wire of the bridge, having a resistance of ·2 ohms, was further lengthened at each end by resistance coils of ten ohms, and it was found that with a little practice one could easily compare two resistances of about two ohms within at least 1,000th of the true ratio.

It was found better to attach the sliding piece to the battery rather than the galvanometer, and it was exceedingly curious to notice the effect of moving the sliding piece so as to gradually diminish the difference of potential at the two terminals of the telephone, the sound diminishing until at last there seemed to be only a slight *uneasiness* produced in the ear, which ceased whenever the contact between the sliding piece and the German silver wire was broken. I have no doubt whatever that with a more delicate instrument than the one employed, which was apparently not nearly so sensitive as that used by Prof. Forbes, one could compare with considerable accuracy electrical resistances in this manner. Of course the telephone could also be employed instead of the galvanometer, in comparing the electromotive forces of batteries, and it is my intention to make more experiments in this direction.

By using a tuning-fork made to vibrate by electricity and a Helmholtz's resonator in conjunction with the telephone, the accuracy of testing may no doubt be largely increased.

HERBERT TOMLINSON

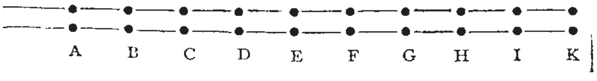
1. IF the cavities above and below the iron disc of an ordinary telephone are filled with wadding, the instrument will transmit and speak with undiminished clearness.

2. On placing a finger on the iron disc opposite the magnet, the instrument will transmit and speak distinctly. It only ceases to act when sufficient pressure is applied to bring plate and magnet into contact.

3. Connecting the centre of the disc by means of a short thread with an extremely sensitive membrane no sound is given out by the latter when a message is transmitted.

4. Ten telephones were connected as represented in the following diagram, on the principle of a battery joined for surface or quantity.

From transmitter—



A, B, C, &c., telephones.

On receiving a message from the transmitter *it could distinctly be heard through any of the ten instruments, although the current had been split up ten times.* (I have no doubt that a greater number of telephones might thus be joined with almost equal effect; from want of instruments I have not been able to find out the limit.)

The following experiments were made with a double telephone, constructed by a battery of horse-shoe magnets with iron cores at their ends. The wires on the bobbins were wound in opposite directions, as on an ordinary electro-magnet.

5. *On connecting the similar poles of the coils (as + and +) and joining the remaining similar poles (as — and —) to line wires the instrument both transmitted and spoke with equal distinctness.*

6. On placing the armature on the horse-shoe magnet no loss of power was perceptible in either transmitting or receiving, nor was there any increase of power on augmenting the number of magnets.

7. If the inner and outer coils of an induction coil are respectively connected with a transmitting and receiving instrument, sound can be distinctly transmitted in either direction.

8. If an ordinary Leyden jar is interposed in the line wire, one end being in contact with the inner, the other with the outer coating, sound can be transmitted, but it is much weakened in strength.

9. Bringing the iron cores of the double telephone in contact with the disc and pressing with the fingers against the plate on the other side, a weak current from a Daniell cell produced a distinct click in the plate, and on drawing a wire from the cell over a file which formed part of the circuit, a rattling noise was produced in the instrument.

Experiments No. 1, 2, 3, and 9 tend to show the absence of mechanical vibration. For the Experiments Nos. 4 and 5 I fail to find a reasonable explanation. No. 6 shows that strength of the magnet has nothing to do with the force of the sound produced, the latter being simply the result of a difference of two opposing forces. Nos. 7 and 8 require no explanation.

The above notes are taken from a paper read by me before the Priestley Club on February 16.

Bradford Grammar School AUREL DE RATTI

IN NATURE, vol. xvii. p. 164, there was a notice of a telephonic alarum in the shape of a tuning-fork. This, however, requires a fixed and special telephone. The following method of attracting attention requires neither. I venture to send it you, as I have seen no notice of any one having tried it; but I can scarcely believe it to be the case, as the thing would suggest itself to any one studying the instrument. It is to include a magneto-electric machine in the circuit, when turning the handle produces a series of taps in the telephone audible at a considerable distance. I have not tried it for any long distance—merely fifty yards. The magneto-electric machine was placed in the observatory, and the telephone, or rather a battery of three telephones, in my study. The noise was heard at the further end of my dining room, the door of which faces that of the study.

Rugby A. PERCY SMITH

EXPERIMENTING with a pair of telephones the other day, I thought I would try if it were possible to utilise underground pipes as conductors. I therefore connected one terminal of each instrument with the gas and the other with the water-pipes, in two houses placed about thirty yards apart, and found that it was possible to carry on conversation by means of the instruments thus connected. The voices were not as distinct as if wire had been used, but singing was very plainly heard. I have not had the opportunity of trying a longer distance; perhaps some of your readers may test the matter further.

Bury, Lancashire WILLIAM STOCKDALE

"Mimicry in Birds"

OWING to the special meaning of late attached to the word "mimicry" by naturalists, the above heading seems liable to mislead when applied to the fact mentioned by Mr. J. Stuart Thomson (page 361). In answer to his inquiry perhaps you will allow me to quote the following from the fourth edition of Yarrell's "British Birds" (vol. ii. p. 229) with respect to the starling.

"Its song is as imitative as that of the vaunted Mocking-bird,

and in nothing perhaps is it more grateful than in the reminiscences it brings to our homes of its wilder associates far afield; for Starlings consort with many kinds of birds, learn their notes and frequently mingle them in their own strain."

And then as a foot-note:—

"Thus the well-known wail of the Lapwing, and the piping note of the Ringed Plover may be heard in places wholly unsuited to the habits of those birds. Messrs. Matthews mention Starlings imitating the cry of the Kestrel, Wryneck, Partridge, Moorhen, and Coot among other birds (Zool. p. 2430). Saxby says that in Shetland the notes of the Oyster-catcher, Golden Plover, Redshank, Curlew, Whimbrel, and Herring-Gull, are perfectly mimicked. Mr. Hooper, of Upton near Didcot, informs the editor that Starlings in that neighbourhood will render exactly the characteristic cry of the Quail and the Corn-Crake. The common sounds of the poultry-yard are often copied with more or less accuracy, and a Duck may be heard to quack, a Hen to cackle, and a Cock to crow from the topmost bough of a tall tree."

It follows that if a Starling can so well imitate the notes of the above-named birds, it would have still less difficulty with those of species much more nearly allied to it, as the Blackbird, Chaffinch, and Sparrow. ALFRED NEWTON

Magdalene College, Cambridge, March 9

The "Geographical" and the Public

QUITE accidentally this evening I noticed in NATURE that Capt. Evans was to read a paper on the Magnetism of the Earth, before the Royal Geographical Society at the London University. Having devoted considerable attention to the subject I was desirous of hearing the paper and hurried up to town. I found, however, that I could not obtain admittance without an order. I offered payment but that was useless. I explained to the doorkeeper that I had come a long distance, was most anxious to hear the paper, and did not know until then the terms of admission, otherwise, as many of my friends are Fellows, I would have supplied myself with the necessary order.

I offered my card and suggested that it might be sent in to Sir Henry Rawlinson, to whom I was known, or to the Secretary or some other official, but to all my endeavours there was a curt, not to say pert, reply.

It occurred to me that if I waited a short time some friend might possibly make his appearance and help me in my "pursuit of knowledge under difficulties." I had not waited many moments when I noticed the door-keeper despatch on an errand a lad who supported him. I was weak-minded enough to imagine he had relented, and that some official would come to my aid. An official did certainly come back with the lad—it was a policeman! who gave me a look which I interpreted to mean, "If you don't be off I'll 'run you in.'" A few words in a very low tone passed between the doorkeeper and himself, and as I had no desire to spend the night in Vine Street station, I departed, feeling that this was an *argumentum ad hominem* which I could not resist. X.

Temple, March 11

Hearing and Smell in Insects

ALL that I have observed leads me to believe that any sensitiveness shown by insects to sound is due to a diffused sensibility to vibration rather than to a differentiated sense like our own. This will sufficiently explain the behaviour of J. C.'s moths (NATURE, vol. xvii. p. 45), and my own larvæ (NATURE, vol. xvii. p. 102). In the one case the ringing glass, and in the other the vibrant wood of the feeding-box communicated the alarm. If anyone, an hour after his kitchen has been left in darkness and quiet, will enter it as gently as possible, without shoes or light, and then, having no contact with anything, other than the unavoidable one of his sock-muffled feet with the floor, will speak suddenly and sharply, I believe he will find that not a cockroach shows any signs of alarm. If, on the other hand, he should drop something heavy abruptly, or enter with his usual step in boots, there is a stampede; but even then nothing to compare with the commotion caused by the introduction of light.

As to smell, there can be no doubt, it seems to me, that it is a very finely-differentiated sense; residing, I suspect, to a great extent, in the antennæ, and probably capable of detecting qualities in substances of which our own analogous sense gives us no warning. The ichneumon flies are an example in point. One of the larger of these alighted inside my open window in the sunshine this afternoon, and I noticed, as often before, the incessant play of his antennæ as he hunted restlessly to and fro, apparently in search of larvæ, or pupæ, concealed under the wood. As the prey of some members of this tribe are always so hidden, and the egg is accurately laid therein, by means of the long ovipositor, without the aid of sight, some other sense, in great perfection, must guide them in their quest. But here is a quite conclusive instance.

I saw in Athens, March, 1864, in the collection of Mr. Merlin, then our vice-consul there, placed in juxta-position in one drawer in his cabinet, a wasp and spider, of which he told me that that species of spider is the habitual prey of that species of wasp, and that he hunts him by scent, nose down, precisely like a hound. He witnessed himself the chase from beginning to end in the case of the actual specimens I saw. It occurred in his own house, and was continued for some time, and across, as I understood him, more than one room. The spider, as soon as he found himself marked down, showed the greatest terror, running hither and thither, with many doubles and turns. These the wasp—a long, thin-bodied variety—followed accurately, turn by turn, never quitting the spider's track for an instant, recovering, when at fault, like a dog, until, after an exciting chase, he seized his exhausted prey, and the keenly-interested human observer secured both pursuer and victim. HENRY CECIL

Bregner, Bournemouth, March 2

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF JULY 29.—Prof. Newcomb has lately issued empirical corrections to Hansen's Lunar Tables, which he proposes to employ in the American Ephemeris for 1883. The errors of the tables have now attained such magnitude, and exhibit so steady an increase, that it becomes necessary to apply corrections, even though they may be of the otherwise unsatisfactory nature of empirical quantities, and it is probable that Prof. Newcomb may not be the only superintendent of an ephemeris who will adopt this course pending the formation of new lunar tables at, it may be hoped, no distant period.

At the time of the total solar eclipse which traverses the United States in July next, Mr. W. Godward finds the correction of the longitude of the moon deduced from Hansen's tables to be $-9''.5$, and the correction of the latitude $+0''.9$, according to Newcomb. Applying these corrections to the moon's place, and adopting Leverrier's diameter of the sun, with a somewhat reduced diameter of the moon from that given by Hansen's tables, which corresponds well in the calculation of eclipses, the following equations are found, which may be expected to give the times of beginning and ending of the total phase with considerable accuracy for any point not far distant from Denver, Colorado, the most important place traversed by the belt of totality.

$$\text{Cos}\, w = 59.7050 - [1.85211] \sin l + [1.71204] \cos l, \cos (L + 216^\circ\ 48'.2)$$
$$t = 9\text{h. } 54\text{m. } 34.2\text{s.} \mp [1.93963] \sin w - [3.56966] \sin l$$
$$- [3.82402] \cos l, \cos (L + 256^\circ\ 25'.6).$$

Here l is the *geocentric* latitude of the point, L its west longitude from Greenwich, to be used with a *negative* sign, and the quantities within square brackets are logarithms; t is the Greenwich mean time of beginning or ending of totality, according as the upper or lower sign of the second term is used, $[1.93963] \sin w$ representing the semi-duration of the total phase; and applying the longitude of the place for which we are calculating in the usual way, the local mean times result.

As an example of the method of using formulæ of reduction similar to the above, which is frequently a matter of doubt to the uninitiated, we may find from them the local mean times of beginning and ending of the total eclipse in 106° 14′ W., and 40° 23′ N., which, according to the *Nautical Almanac* elements, is the position of the central eclipse at 10h. 28m. Greenwich mean time.

The reduction of the geographical to the geocentric